



Original article

Early results of inguinal hernia repair by the 'mesh plug' technique – first 200 cases

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Introduction: Inguinal hernia repair is the most common surgical procedure performed in the UK.^{1,2} Evidence from several earlier studies suggests that primary inguinal hernia repair has a high recurrence rate of 10–15%.^{3–6} The Royal College of Surgeons of England guidelines suggested the use of layered suture (Shouldice) or prosthetic (Lichtenstein) repair.² Per-fix plugs have been used in the US for more than a decade with excellent results. This study was a series of 200 consecutive cases. The aim was to evaluate the mesh plug technique in the repair of all types of inguinal hernias and its results in one consultant practice within a district general hospital.

Patients and Methods: In a 15-month period between 1997 and 1998, all patients with inguinal hernias presenting to the general surgical clinic of one consultant were recruited to the study. All had mesh plug repair under local ($n = 40$), regional ($n = 50$) or general ($n = 110$) anaesthesia either by the consultant, associate specialist or specialist registrar (following initial training), using the same standard technique. The majority 80% ($n = 160$) were done as day cases. The results were evaluated by questionnaire and personal outpatient review initially at 3 weeks, then at 1 year (9–13 months).

Results: 200 consecutive patients with inguinal hernias underwent mesh plug repair; mean age was 54 years (95% CI, 46–61). The majority of patients had primary ($n = 180$) and others had recurrent ($n = 20$) hernia. All types of hernia (Gilbert's I–VII) were included. Median follow-up was 1 year (9–15 months). Groin pain, which was the leading symptom at presentation, was relieved in 96% of the patients; 79% returned to previous jobs within 4 weeks (95% CI, 0.71–0.87). All retired patients resumed normal life activities within 2 days. Postoperative pain was minimal; 28 patients did not require any postoperative analgesia. There were very few minor ($n = 6$) and no major complications. During the follow-up, one recurrence occurred.

Conclusions: Mesh plug repair is associated with minimal postoperative pain, quick recovery and return to work. It is an ideal technique for day-case surgery. Although longer follow-up will be required to assess true recurrence rate, so far the recurrence rate at 0.5% is acceptable, particularly in the light of other published series.

Key words: Inguinal hernia – Mesh plug technique

In the UK, inguinal hernia represents 6% of all surgical admissions, 8% of all surgical operations and occupies 5% of all general surgical beds.⁷ Various operative techniques have been used – varying from open to laparoscopic repair – to achieve better results in terms of minimal postoperative pain, rapid rehabilitation and to minimize recurrence. In 1986, Lichtenstein used the term 'tension-free' for his repair technique, in which a sheet of polypropylene mesh is used to strengthen the fascia transversalis.⁸ It is the most favoured technique in the UK, as it offers an effective repair and is easy to perform.⁹ Lately, mesh plug hernioplasty has started gaining attention. In the US, this technique has been used extensively in some centres with good results.¹⁰ It is a much simpler technique than that of Lichtenstein, where a polypropylene mesh plug is inserted at the defect site like a cork stopper at the bottle mouth.¹¹

In the present study, we chose this repair to see if the outcome of surgery matched the established results in our clinic and to verify the claim that this is a day-case procedure with early return to work.¹⁰

Patients and Methods

In a 15-month period between 1997 and 1998, all patients with inguinal hernia presenting to the general surgical clinic of one consultant were recruited to the study. For demographic data see Table 1.

The leading symptom was groin pain, noted in 140 patients. Gilbert's classification was used to differentiate the hernias,^{10–13} according to which types I, II and III were indirect inguinal hernia, type I with a tight internal ring, type II with an internal ring diameter up to 4 cm and type III above 4 cm. Type IV was a diffuse direct hernia with a generalised weakness of the entire floor and type V was a diverticular defect. Type VI consisted of both direct and indirect elements and VII was a femoral hernia. Patient distribution according to Gilbert's classification is shown in Table 2.

Table 1 Demographics

Male	5% (n = 190/200)
Female	5% (n = 10/200)
Age	Mean 54 years (range, 26–89 years)

Table 2 Distribution according to hernia type

Patients' distribution according to	Gilbert's classification system
I	4 (2%)
II	62 (31%)
III	60 (30%)
IV	8 (4%)
V	60 (30%)
VI	6 (3%)
VII	Nil

Of the 200 cases, 160 patients (80%) were treated as day-cases — 110 patients (55%) received general anaesthetic, 50 patients (25%) underwent epidural/spinal anaesthesia, and 40 patients (20%) received local anaesthetic. All patients received peri-operative antibiotics.

Technique

The plug mesh repair consists of a 2-inch groin incision. The external oblique muscle is opened in the direction of its fibres. The cord is opened and the indirect sac is pushed back into the abdominal cavity without opening the sac. The peritoneal sac is not ligated. A plug is then inserted in the deep ring and secured to the ring with prolene 2/0 interrupted stitches in 3–4 places. In all cases a lipoma of the cord, when present, is excised. In cases of direct hernia, the base of the defect is circumcised by electric cautery. The plug is then inserted and secured with 3–4 interrupted prolene stitches. An onlay mesh is placed without securing, it but the lateral split end is approximated with one prolene stitch. The external oblique is closed with polysorb 2/0 and the skin is closed with subcuticular polysorb 3/0.

In cases of repair of recurrent hernia, the sac is freed and reduced through the margins of the defect and a plug is inserted to occlude the defect. The plug is then secured with 3–4 interrupted prolene stitches.

Postoperative instructions

Patients were encouraged to return to daily life activity when comfortable. They were allowed to lift weights under 20 lb at any time after surgery and heavy objects within two weeks of operation. A questionnaire was

handed to the patients with pre-paid envelopes to record the analogue pain score³⁰⁻³² 24 h after surgery and their rehabilitation and return to work. Patients were instructed to attend the ward if they were worried.

Follow-up

The first follow-up check was performed three weeks after operation in the out-patient clinic and then by a proforma sent to patients a year later.

Results

Patients

A total of 208 operations were performed in 200 cases: 172 (86%) were primary repairs for unilateral hernias; 8 (4%) were bilateral hernias; and 20 (10%) were recurrent after a previous open repair. These patients were categorized as in Table 3.

Relief of symptoms

Groin pain, which was the presenting symptom in 70% ($n = 140$) patients, was relieved in 96%. Only 4% ($n = 8$) continued to experience numbness and tingling sensation. There was one patient (0.5%) who developed testicular pain without any orchitis.

Length of stay

The mean postoperative stay was 4 h in day-cases, which comprised 80% ($n = 160$) of the patients: 18% (n

Table 3 Distribution according to physical activity

Occupation	
Manual labourers	30% ($n = 60/200$)
Sedentary workers	20% ($n = 40/200$)
Retired/jobless	50% ($n = 100/120$)

Table 4 Length of hospital stay

Length of hospital stay	Primary unilateral	Primary bilateral	Recurrent hernia	Total
4-6 h	69.5% ($n = 139/200$)	3.5% ($n = 7/200$)	7% ($n = 14/200$)	80% ($n = 160/200$)
1 day	14.5% ($n = 29/200$)	0.5% ($n = 1/200$)	3% ($n = 6/200$)	18% ($n = 36/200$)
2 days	2% ($n = 4/200$)	Nil	Nil	2% ($n = 4/200$)

Table 5 Early postoperative pain

Postoperative pain in first 2 weeks	
No pain	5 (2.5%)
Pain - no analgesics needed	23 (11.5%)
Pain - occasional analgesics	137 (68.5%)
Pain - regular analgesics	35 (17.5%)

Table 6 Postoperative complications

Complications	Cases
Seroma/haematoma	4
Superficial wound infection	2
Deep infections	Nil
Recurrence	1
Urinary infection	Nil
Testicular atrophy	Nil

= 36) stayed overnight and 2% ($n = 4$) were discharged on the second postoperative day due to medical and social reasons. There was no difference in the length of stay for the different types of hernia classified according to Gilbert's scheme (Table 4).

Analgesics

The level of pain was determined by the analogue pain score, which did not show any significant difference in the various type of hernia.³⁰⁻³² The pain score was 3 (1-9) at 24 h. The 95% confidence interval for the proportion of patients who recorded a score of 1, 2 or 3 within the first 24 h of the operation was 0.61-0.74.

All patients were discharged home with paracetamol (Table 5). Of those who took regular analgesics for more than two weeks, 23 were under 50 years of age.

Complications

There were no major complications or deaths. The postoperative complications are listed in Table 6. Cases of wound infection were treated with a course of antibiotics.

Recurrence

One patient (0.5%) had recurrence of hernia which, on subsequent exploration, was found to be a missed sac rather than a true recurrence.

Rehabilitation

Of those who were previously working, 79% (79/100) returned to work within 4 weeks (95% CI = 0.71-0.87); 65% ($n = 39/60$) of physical labourers returned to work within 4 weeks (95% CI = 0.53-0.77) and 34% ($n = 21$)

took more than 4 weeks (range, 4–9 weeks) before they resumed duty. Retired and jobless patients resumed daily life activity within 2 days. Only 2% of cases did not return the proforma.

Patient satisfaction

Patient satisfaction was 95%.

Follow-up

All attended clinics at 3 weeks postoperatively. Follow-up by proforma or telephone interview at a year (9–13 months) was 98%.

Discussion

The concept of tension-free hernia repair by using a plug was first reported by Lichtenstein and Shore¹⁴ and later by Shocket.¹⁵ In 1987, Gilbert reported a series of 'sutureless' hernia repairs with plug technique which he used for small and moderately sized hernias.^{16,17} Later, in a published series of 1563 hernia repairs performed by Robins and Rutkow, mesh plugs were used for all types of groin hernia.¹⁰ The causes of inguinal hernia are multifactorial. Altered collagen metabolism plays an important role in hernia formation.²⁷ Male inguinal hernia is associated with a metabolic disorder of collagen in the fibroconnective tissue of the groin.^{19,20} This leads to weakness of transversalis fascia. The use of synthetic materials that stimulate normal collagen production is an effective approach to deal with inguinal hernia repair.²⁷ The plug is a cone-shaped marlex mesh which is anchored to the internal ring and, in cases of direct hernia, to the base of the defect with prolene 2/0. Marlex (Bard Vascular System, Billerica, MA, USA) induces an intense inflammatory response and enhances fibroblastic growth and collagen synthesis and forms a firm barrier against herniation.^{7,18} In addition, it does not promote infection or seroma formation.¹⁸ Using a mesh to re-enforce groin tissue is an effective approach, tension-free and physiological. In the Lichtenstein technique, a wide tissue plane is dissected extending medial to the pubic tubercle and lateral to the cord, and may involve anchoring the mesh sheath continuously or at intervals. The Bassini technique is against basic surgical principles as it involves approximation of tissue which is already weak and unhealthy and puts it under tension.²¹ Forming a new wall with stitches leads to pain and slow recovery and is biologically weak.²² In a clinical trial of mesh repair for groin hernia, it was seen that the

recurrence rate reduced to one-third if mesh was used as compared to conventional herniorraphies.²³ The plug technique of hernia repair can be performed through a small incision and involves minimal tissue dissection. The plug is pliant and, therefore, the repair is tension free. The sac is invaginated without ligation. With this technique, there is more patient comfort postoperatively and, therefore, it permits rapid rehabilitation with a diminished complication rate.¹¹

It is a simple, operator-friendly technique that is easy to learn and perform. The incidence of peri-operative and postoperative complications is minimal.

Most of the patients return to routine life within 48 h: 65% of physical labourers returned to work within 4 weeks. One of the factors contributing to early return to work was probably because all these patients were followed up at 3 weeks and strongly encouraged to do so. Majeed and Brown²⁴ showed that return to work was heavily influenced by the respective GP, with some advocating 6 weeks to 3 months before returning to work for heavy manual labourers. Therefore, it is important to motivate patients for early return to work as studies have shown there is no evidence of increase recurrence rate^{25,26} with early return to work.

In the present study, 80% of the patients were treated as day-cases. According to The Royal College of Surgeons of England guidelines,² over 30% of elective hernia repairs should be performed as day-cases and we were successful in achieving this target, although in the series of plug repair reported by Robins and Rutkow all the cases were performed as day-cases.¹⁰

One interesting finding was that the patients who needed regular analgesics were mostly under 50 years of age. The type of hernia had no influence on the post-operative pain score, although young patients had a higher pain score. This age dependency has been shown in other surgical series.²⁹

Patients who underwent surgery for recurrent hernia did not involve dissecting out adherent scarred area on different tissue planes; instead, a much simpler technique of dissection of sac without dissecting the various anatomical layers and cord was performed. The peritoneal sac was not ligated either, as it was considered to be related to more postoperative pain.²⁸ This led to excellent postoperative rehabilitation. There was one recurrence which, on subsequent exploration, was found to be a missed sac rather than a true recurrence.

Conclusions

This prospective study of 200 patients suggests that, with this technique, 80% of cases can be operated on as

day cases with good postoperative pain control and early return to work; however, long-term follow-up is needed to evaluate long-term recurrence.

In our experience, this technique has proved to be very simple and easy to perform. There is minimal postoperative pain and early mobilization and return to work is usual. Therefore, we recommend it for treatment of all primary and recurrent groin hernias.

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References

1. Anon. Hospital activity. In: *Health and Personal Social Services Statistics for England*. London: HMSO, 1994; 46.
2. The Royal College of Surgeons of England Working Party. *Clinical Guidelines on the Management of Groin Hernia in Adults*. London: RCSE, 1993.
3. Halverson K, McVay CB. Inguinal and femoral hernioplasty. *Arch Surg* 1970; **101**: 127–32.
4. Weinstein M, Roberts M. Recurrent inguinal hernia: follow-up study of 100 postoperative patients. *Am J Surg* 1975; **129**: 564–9.
5. Berliner SD, Burson L, Katz E, Wise L. An anterior transversalis fascia repair for adult inguinal hernias. *Am J Surg* 1978; **135**: 633–66.
6. Shulman AG, Amid PK, Lichtenstein IL. The 'plug' repair of 1402 recurrent inguinal hernias: a twenty-year experience. *Arch Surg* 1990; **125**: 265–7.
7. Lafferty PM, Malinowska A, Pelta D. Lichtenstein inguinal hernia repair in a primary healthcare setting. *Br J Surg* 1998; **85**: 793–6.
8. Lichtenstein IL, Shulman AG, Amid PK, Montllor MM. The tension-free hernioplasty. *Am J Surg* 1989; **157**: 188–93.
9. Mills IW, McDermott IM, Ratliff DA. Prospective randomized controlled trial to compare skin staples and polypropylene for securing the mesh in inguinal hernia repair. *Br J Surg* 1998; **85**: 790–2.
10. Rutkow IM, Robbins AW, Freehold NJ. Tension free inguinal herniorrhaphy: a preliminary report on the 'mesh plug' technique. *Surgery* 1993; **114**: 3–8.
11. Robbins AW, Rutkow IM. The mesh plug hernioplasty. *Surg Clin North Am* 1993; **73**: 501–12.
12. Gilbert AL. An anatomical and functional classification for the diagnosis and treatment of inguinal hernia. *Am J Surg* 1989; **157**: 331–3.
13. Gilbert AL. Prosthetic adjuvants to groin hernia repair: a classification of inguinal hernias. *Contemp Surg* 1988; **32**: 28–35.
14. Lichtenstein I, Shore JM. Simplified repair of femoral and recurrent inguinal hernia by a 'plug' technique. *Am J Surg* 1974; **128**: 439–44.
15. Shockett E. Routine rapid preperitoneal Marlex mesh buttressing in the repair of all inguinal hernias. *Contemp Surg* 1985; **26**: 22–7.
16. Gilbert AL. Inguinal hernia repair: biomaterials and suture-less repair. *Perspect Gen Surg* 1991; **2**: 113–29.
17. Gilbert AL. Suture-less repair of inguinal hernia. *Am J Surg* 1992; **163**: 331–5.
18. Amid PK, Shulman AG, Lichtenstein IL, Hakakha M. Biomaterials for abdominal wall hernia surgery and principles of their applications. *Langenbecks Arch Chir* 1994; **379**: 168–71.
19. Wagh PV, Leverick AP, Sun CN, White HJ, Read RC. Direct inguinal herniation in men: a disease of collagen. *J Surg Res* 1974; **17**: 425–7.
20. Read RC. A review: the role of protease-antiprotease imbalance in pathogenesis of herniation and AAA in certain smokers. *Post Grad Gen Surg* 1992; **4**: 161–5.
21. Amid PK, Shulman AG, Lichtenstein IL. The Lichtenstein open 'tension-free' mesh repair of inguinal hernias. *Surg Today* 1995; **25**: 619–25.
22. Campanelli GP, Cavagoli R, Gabrielli F, Pietri P, Trabucco's procedure and local anaesthesia in surgical treatment of inguinal and femoral hernia. *Int Surg* 1995; **80**: 29–34.
23. Friis E, Lindahl F. The tension-free hernioplasty – a randomized trial. *Am J Surg* 1996; **172**: 315–9.
24. Majeed AW, Brown S, Williams N, Hannay DR, Johnson AG. Variations in medical attitudes to post-operative recovery period. *BMJ* 1995; **311**: 296.
25. Bourke JB, Lear PA, Taylor M. Effect of early return to work after elective repair of inguinal hernia: clinical and financial consequences at one year and three years. *Lancet* 1981; **ii**: 623–5.
26. Schulman AG, Amid PK, Lichtenstein IL. Returning to work after herniorrhaphy. 'Take it easy is the wrong advice'. *BMJ* 1994; **309**: 216–7.
27. Friedman DW, Boyd CD, Norton P, Greco RS, Boyarsky AH, Mackenzie JW, Deak SB. Increase in type III collagen gene expression and protein synthesis in patients with inguinal hernias. *Ann Surg* 1993; **218**: 754–60.
28. Shulman AG, Amid PK, Lichtenstein IL. Ligation of hernial sac; a needless step in adult hernioplasty. *Int Surg* 1993; **78**: 152–3.
29. Moore AK, Vilderman S, Lubenskyi W, McCans J, Fox GS. Difference in epidural requirements between elderly and young patients after abdominal surgery. *Anesth Analg* 1990; **70**: 316–20.
30. Huskisson EC. Measurement of pain. *Lancet* 1974; **ii**: 1127–31.
31. Scott J, Huskisson EC. Vertical or horizontal visual analogue scales. *Ann Rheum Dis* 1979; **38**: 560–3.
32. Bercker M, Hughes B. Using a tool for pain assessment. *Nurs Times* 1990; **86**: 50–2.